CLAIMS

I claim:

1) A nuclear waste remediation process for treating long-lived radioisotopes by transmuting them into short-lived radioisotopes or non-radioactive isotopes, comprising:

   1) accelerating electrons in an accelerator;
   2) impacting a target of high atomic number with said electrons;
   3) generating, on said impact, a flux of giant resonant gamma rays from said target;
   4) bombarding nuclei of long-lived radioisotopes with said gamma ray flux, so that a neutron is ejected from said nuclei; and
   e) therefore producing a product of short-lived isotopes or non-radioactive isotopes of reduced atomic mass.

2) The process of claim 1 wherein the long-lived radioisotopes includes radioactive atoms selected from the group consisting of Cs^{137}, Sr^{90}, I^{129}, and Tc^{99}.

3) The process of claim 1 wherein said long-lived radioisotopes include radioactive atoms with atomic numbers exceeding 50.

4) The process of claim 1 wherein the flux of giant resonant gamma rays have an energy of 5-14 MeV.

5) A method for reducing the long-term toxicity of radioactive waste comprising:

   5) using a linear accelerator to accelerate electrons;
   6) using said accelerated electrons to impact a high Z target;
   7) using said high Z target to generate a flux of giant resonant gamma rays;
   8) impacting radioactive waste with said flux of giant resonant gamma rays to eject a neutron from nuclei of radioactive isotopes in said radioactive waste, and producing a product isotope of reduced atomic mass;

wherein long-term toxicity of the radioactive waste is thereby reduced.

6) The method of claim 5 wherein said radioactive isotopes include radioactive atoms selected from the group consisting of Cs^{137}, Sr^{90}, I^{129}, and Tc^{99}.

7) The method of claim 5 wherein said radioactive isotopes include radioactive atoms with atomic numbers exceeding 50.

8) A radioactive waste transmutation facility comprising:

1) an accelerator for electron acceleration;
2) a high atomic number target for receiving the impact of accelerated electrons;
3) an adjustable flux controller for controlling the flux of giant resonant gamma rays emerging from said target throughout the duration of said impact;
4) a reactor system for subjecting a quantity of radioactive isotopes to bombardment of the controlled gamma ray flux to eject a neutron from nuclei of said radioactive isotopes by photodisintegration;
5) a duration control system for controlling the duration of photodisintegration and the corresponding transmutation of said radioactive isotopes;

wherein the transmutation facility is thereby adapted to reduce the long-term radioactivity of the radioactive waste.

9. The commercial radioactive waste transmutation facility of claim 8 wherein the radioactive isotopes includes atoms from the group consisting of Cs^{137}, Sr^{90}, I^{129}, and Tc^{99}.

10. The commercial radioactive waste transmutation facility of claim 8 wherein the radioactive isotopes include atoms whose atomic number exceeds 50.

11. The method of Claim 5, wherein the flux of giant resonant gamma rays have an energy of 5-14 MeV.

12. The radioactive waste transmutation facility of Claim 8, wherein the flux of giant resonant gamma rays have an energy of 5-14 MeV.

13. A nuclear waste remediation process for treating long-lived radioisotopes by transmuting them into short-lived or non-radioactive isotopes, comprising:

accelerating electrons in an accelerator;

providing a long-lived radioisotope;

irradiating said radioisotope with said electrons to produce bremstrahlung photons within said radioisotope, wherein:

said photons react with nuclei of said radioisotope to eject a neutron from said nuclei, thereby producing a short-lived or non-radioactive product of reduced atomic mass.

14. A method for reducing the long-term toxicity of radioactive waste comprising:

using a linear accelerator to accelerate electrons;

using said accelerated electrons to impact radioactive isotopes to generate a flux of giant resonant gamma rays, wherein:

said gamma rays react with the nuclei of said radioactive isotopes to eject a neutron from said nuclei of said radioactive isotopes, thereby producing a product isotope of reduced atomic mass wherein long-term toxicity of the radioactive waste is thereby reduced. A radioactive waste transmutation facility comprising:

a chemical separation plant for separating radioactive isotopes from radioactive waste;

an accelerator for electron acceleration;

a high atomic number target for receiving the impact of accelerated electrons;

an adjustable flux controller for controlling the flux of giant resonant gamma rays emerging from said target throughout the duration of said impact;

a reactor system for subjecting a quantity of said separated radioactive isotopes to bombardment of the controlled gamma ray flux to eject a neutron from nuclei of said separated radioactive isotopes by photodisintegration;

a duration control system for controlling the duration of photodisintegration and the corresponding transmutation of said separated radioactive isotopes;

wherein the transmutation facility is thereby adapted to reduce the long-term radioactivity of the radioactive waste.